CLAIMS

1. A process for generating a chlorine dioxide solution, comprising:

acidifying an alkali metal chlorite solution to produce a chlorous acid feedstream;

dissolving a solid phase chlorine-containing material to produce a dissolved chlorine-containing material feedstream; and

mixing the chlorous acid feedstream and the dissolved chlorine-containing material feedstream to produce a chlorine dioxide effluent.

2. The process according to Claim 1, wherein the solid phase chlorine-containing material is selected from the group consisting of calcium hypochlorite, lithium hypochlorite, sodium hypochlorite, dichloroisocyanurate, trichloroisocyanurate, and mixtures thereof.

3. The process according to Claim 1, wherein acidifying the alkali metal chlorite solution comprises lowering a pH of the solution to about 2 to about 3.

4. The process according to Claim 1, wherein acidifying the alkali metal chlorite solution comprises exchanging an alkali metal ion in the alkali metal chlorite solution with a hydrogen ion to produce chlorous acid.

5. The process according to Claim 1, wherein acidifying the alkali metal chlorite solution comprises contacting the alkali metal chlorite solution with a protic acid.

6. The process according to Claim 5, wherein the protic acid is selected from the group consisting of hydrochloric acid, hydrobromic acid, hydriodic acid, nitric acid, sulfuric acid, perchloric acid and mixtures thereof.

7. The process according to Claim 1, wherein acidifying the alkali metal chlorite solution lowers a pH of the solution to less than 7.

8. The process according to Claim 1, wherein dissolving the solid phase chlorine-containing material comprises contacting the material with water for a contact time of about 20 to about 800,000 minutes, wherein the contact time is a volume of water in divided by a pump draw flow rate.

9. The process according to Claim 1, wherein acidifying the alkali metal chlorite solution comprises electrochemically acidifying a sodium chloride solution to produce a hydrogen chloride solution and contacting the hydrogen chloride solution with the alkali metal chlorite.

10. The process according to Claim 1, wherein the alkali metal chlorite solution is a sodium chlorite solution.

11. The process according to Claim 1, wherein the alkali metal chlorite solution to chlorine dioxide has a conversion efficiency greater than 90 %.

12. The process according to Claim 1, wherein the dissolved chlorine-containing material feedstream has a pH of 2.5 to 13.5.

13. The process according to Claim 1,wherein the solid phase chlorine-containing material has a contact area per unit volume of solution of about 0.0002 cm^{-1} to about 3.14 cm^{-1}.

14. The process according to Claim 1, wherein mixing the chlorous acid feedstream and the dissolved chlorine-containing material feedstream is at a temperature of about 5 to about 60 °C.

15. The process according to Claim 1, wherein the solid phase chlorine-containing material is a form selected from the group consisting of tablets, rods, pellets, granules and mixtures thereof.

16. The process according to Claim 1, wherein mixing the chlorous acid feedstream and the dissolved chlorine-containing material feedstream is at a reaction time of 0.1 to 100 minutes, wherein the reaction time is a reaction column volume divided by a volumetric flow rate.

17. The process according to Claim 1, wherein the solid phase chlorine-containing material has a solubility limit of 0.1 to 500 grams per liter.

18. The process according to Claim 1, wherein the chlorine dioxide effluent is at a pH of 1 to 7.

19. The process according to Claim 1, further comprising gravity feeding additional solid phase chlorine-containing material as the solid phase chlorine-containing material is dissolved.

20. A system for generating chlorine dioxide, comprising:

a first apparatus for producing a chlorous acid feedstream;

a second apparatus for producing a feedstream comprising a dissolved chlorine-containing material, wherein the second apparatus comprises a vessel partially filled with water; an outlet in fluid communication with the water; a cartridge having a lower portion in fluid communication with the water; and a solid phase chlorine-containing material disposed within the cartridge, wherein a portion of the solid phase chlorine-containing material is submerged in the water to produce a dissolved chlorine-containing material feedstream from the vessel outlet; and

a reactor comprising an inlet for receiving and mixing the chlorous acid feedstream and the dissolved chlorine-containing material feedstream; and an outlet for discharging a chlorine dioxide effluent.

21. The system of Claim 20, wherein the first apparatus comprises an electrochemical acidification cell comprising a plurality of compartments, wherein at least one compartment electrolytically produces the chlorous acid from an alkali metal chlorite salt.

22. The system of Claim 20, wherein the first apparatus comprises an aqueous acid source and an aqueous alkali metal chlorite source in fluid communication therewith to produce the chlorous acid feedstream.

23. The system of Claim 20, the first apparatus comprises a cation exchange cartridge in fluid communication with an alkali metal chlorite solution, wherein the cation exchange column comprises a cation exchange resin in a hydrogen form.

24. The system of Claim 20, wherein the solid phase chlorine-containing material comprises a plurality of tablets stackedly arranged in the cartridge.

25. The system of Claim 20, wherein the solid phase chlorine-containing material is selected from the group consisting of calcium hypochlorite, sodium hypochlorite, lithium hypochlorite, dichloroisocyanurate, trichloroisocyanurate, and mixtures thereof.

26. The system of Claim 20, wherein the second apparatus further comprises a float valve in operative communication with a water inlet, wherein the float valve is adapted to maintain a predetermined level of the water in the vessel.

27. A system for producing chlorine dioxide, comprising:

an electrochemical acidification cell comprising an anode compartment comprising an anode, a cathode compartment comprising a cathode, and a central compartment positioned between the anode and cathode compartments, wherein the central compartment comprises a cation exchange material and an outlet in fluid communication with a conduit;

an alkali metal chlorite solution in fluid communication with the central compartment of the acidification cell;

a water source in fluid communication with the anode and cathode compartments; and

a vessel in fluid communication with the conduit and downstream from the electrochemical acidification cell, wherein the vessel is partially filled with water and comprises an outlet in fluid communication with the water; a cartridge having a lower portion with openings in fluid communication with the water; and a solid phase chlorine-containing material disposed within the cartridge, wherein a portion of the solid phase chlorine-containing material is submerged in the water within the cartridge to produce a dissolved chlorine-containing material feedstream from the vessel outlet.

28. The system of Claim 27, wherein the cation exchange material is selected from the group consisting of strong acid polystyrene divinylbenzene crosslinked resins, weak acid polystyrene divinylbenzene crosslinked resins, iminoacetic acid polystyrene divinylbenzene crosslinked chelating selective cation exchange resins, synthetic inorganic cation exchangers and naturally occurring cationic exchangers.

29. The system of Claim 27, wherein the solid phase chlorine-containing material is selected from the group consisting of calcium hypochlorite, sodium hypochlorite, lithium hypochlorite, dichloroisocyanurate, trichloroisocyanurate, and mixtures thereof.

30. The process according to Claim 27, wherein the electrochemical acidification cell produces a reaction medium pH of about 2 to about 3.

31. The process according to Claim 27, wherein the vessel further comprises a float valve in operative communication with a water inlet, wherein the float valve is adapted to maintain a predetermined level of the water in the vessel.

32. The process according to Claim 27, wherein the solid phase chlorine-containing material has a solubility limit of 0.1 to 500 grams per liter.

33. The process according to Claim 27, wherein the solid phase chlorine-containing material has a contact area per unit volume of solution of about 0.0002 cm^{-1} to about 3.14 cm^{-1}.

34. The process according to Claim 27, wherein the water in the vessel is at a temperature of about 5 to about 60°C.